

What is claimed is:

- 1        1.    A method comprising:  
2        forming a dielectric layer on a substrate;  
3        forming a metal interconnect in an opening in the  
4 dielectric layer; and  
5        treating the dielectric layer with a solvent in a  
6 sonication bath to form pores in the dielectric layer.
- 1        2.    The method of claim 1 wherein forming a metal  
2 interconnect in an opening in the dielectric layer  
3 comprises forming a dual damascene metal interconnect.
- 1        3.    The method of claim 1 wherein treating the  
2 dielectric layer with a solvent in a sonication bath  
3 comprises immersing the substrate in a solvent.
- 1        4.    The method of claim 1 wherein forming a metal  
2 interconnect in an opening in the dielectric layer  
3 comprises forming smooth sidewalls on the metal  
4 interconnect.
- 1        5.    The method of claim 1 further comprising forming  
2 a capping layer over the dielectric layer.
- 1        6.    The method of claim 1 wherein treating the  
2 dielectric layer with a solvent in a sonication bath

3 comprises providing sonic energy to the sonication bath in  
4 a frequency range of about 10 kilohertz to about 2000  
5 kilohertz.

1 7. The method of claim 1 wherein the dielectric  
2 layer includes a porogen having a thermal stability greater  
3 than about 400 degrees C.

1 8. The method of claim 7 wherein the porogen  
2 comprises poly(vinyl alcohol).

1 9. The method of claim 7 wherein the porogen  
2 comprises polycarbonate.

1 10. A method comprising:  
2 forming a metal interconnect in a dielectric material  
3 on a semiconductor substrate; and  
4 directing an electron beam at the dielectric material  
5 to form pores in the dielectric material.

1 11. The method of claim 10 wherein directing the  
2 electron beam at the dielectric material comprises exposing  
3 at least most of the dielectric material to an electron  
4 beam flood.

1        12. The method of claim 10 wherein directing the  
2 electron beam at the dielectric material comprises scanning  
3 the electron beam across the dielectric material.

1        13. The method of claim 10 wherein directing an  
2 electron beam at the dielectric material further comprises  
3 fragmenting some of the dielectric material.

1        14. The method of claim 10 further comprising forming  
2 the dielectric material on the semiconductor substrate, the  
3 dielectric material having a pore-generating material  
4 therein with a thermal stability greater than about 400  
5 degrees C.

1        15. The method of claim 14 wherein the pore-  
2 generating material comprises poly(methyl methacrylate).

1        16. A device comprising:  
2 a semiconductor substrate having at least one layer  
3 with conductive metal lines thereon;  
4 a dielectric material between the metal lines, the  
5 conductive metal lines having smooth sidewalls adjacent the  
6 dielectric material.

1        17. The device of claim 16 wherein the dielectric  
2 material is at least 50% porous.

1        18. The device of claim 16 wherein the dielectric  
2 material is over a conductive layer.

1        19. The device of claim 16 wherein the dielectric  
2 material comprises a carbon-doped oxide.

1        20. The device of claim 16 wherein the dielectric  
2 material has a dielectric constant below about 3.0.

1        21. The device of claim 16 wherein the dielectric  
2 material comprises fluorinated silica glass.

1        22. The device of claim 16 wherein the dielectric  
2 material is a silsesquioxane-based material.

1        23. The device of claim 16 wherein the dielectric  
2 material has a thermal stability greater than about 400  
3 degrees C.